

Amendments to the Claims

Claims 1-26 (Cancelled)

Claim 27 (New) A dielectric loaded antenna apparatus comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide.

Claim 28 (New) A dielectric loaded antenna apparatus comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide toward

one of a polarization direction of the electromagnetic wave and a direction perpendicular to the polarization direction of the electromagnetic wave.

Claim 29 (New) A dielectric loaded antenna apparatus comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said feeding waveguide is arranged so that a central axis of said feeding waveguide in an axial direction of said feeding waveguide is shifted from a center of said column-shaped radiation waveguide.

Claim 30 (New) The dielectric loaded antenna apparatus as claimed in claim 27,

wherein a cross section of said column-shaped loaded dielectric perpendicular to the axial direction of said column-shaped loaded dielectric has a shape of one of a circle, an ellipse and a polygon.

Claim 31 (New) The dielectric loaded antenna apparatus as claimed in claim 28,

wherein a cross section of said column-shaped loaded dielectric perpendicular to the axial direction of said column-shaped loaded dielectric has a shape of one of a circle, an ellipse and a polygon.

Claim 32 (New) The dielectric loaded antenna apparatus as claimed in claim 29,

wherein a cross section of said column-shaped loaded dielectric perpendicular to the axial direction of said column-shaped loaded dielectric has a shape of one of a circle, an ellipse and a polygon.

Claim 33 (New) The dielectric loaded antenna apparatus as claimed in claim 27,

wherein an interior of said waveguide is filled with a dielectric.

Claim 34 (New) The dielectric loaded antenna apparatus as claimed in claim 28,

wherein an interior of said waveguide is filled with a dielectric.

Claim 35 (New) The dielectric loaded antenna apparatus as claimed in claim 29,

wherein an interior of said waveguide is filled with a dielectric.

Claim 36 (New) A dielectric loaded antenna apparatus comprising:

a dielectric substrate;

a microstrip line formed on said dielectric substrate;

a feeding patch conductor provided on an end portion of said microstrip line; and

a column-shaped loaded dielectric loaded on said end portion of said microstrip line, whereby said feeding patch conductor feeds an electromagnetic wave to said column-shaped loaded dielectric, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric,

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a center of said feeding patch conductor.

Claim 37 (New) A dielectric loaded antenna apparatus comprising:

a dielectric substrate;

a microstrip line formed on said dielectric substrate;

a feeding patch conductor provided on an end portion of said microstrip line; and

a column-shaped loaded dielectric loaded on said end portion of said microstrip line, whereby said feeding patch conductor feeds an electromagnetic wave to said column-shaped loaded dielectric, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric,

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a center of said feeding patch conductor toward one of a polarization direction of the electromagnetic wave and a direction perpendicular to the polarization direction of the electromagnetic wave.

Claim 38 (New) A dielectric loaded antenna apparatus comprising:

a dielectric substrate;
a microstrip line formed on said dielectric substrate;
a feeding patch conductor provided on an end portion of said microstrip line; and
a column-shaped loaded dielectric loaded on said end portion of said microstrip line, whereby said feeding patch conductor feeds an electromagnetic wave to said column-shaped loaded dielectric, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric,
wherein said microstrip line is arranged so that a central axis of said microstrip line is shifted from a center of said feeding patch conductor.

Claim 39 (New) The dielectric loaded antenna apparatus as claimed in claim 27, further comprising a radome covering the dielectric loaded antenna apparatus,

wherein said radome and said column-shaped loaded dielectric are formed integrally with each other.

Claim 40 (New) The dielectric loaded antenna apparatus as claimed in claim 28, further comprising a radome covering the dielectric loaded antenna apparatus,

wherein said radome and said column-shaped loaded dielectric are formed integrally with each other.

Claim 41 **(New)** The dielectric loaded antenna apparatus as claimed in claim 29, further comprising a radome covering the dielectric loaded antenna apparatus,

wherein said radome and said column-shaped loaded dielectric are formed integrally with each other.

Claim 42 **(New)** A dielectric loaded antenna apparatus comprising:

a feeding line including a waveguide and a microstrip line;

a column-shaped loaded dielectric loaded on an end portion of said feeding line, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric; and

a converter inserted between said waveguide and said microstrip line, said converter matching impedance between said waveguide and said microstrip line.

Claim 43 **(New)** The dielectric loaded antenna apparatus as claimed in claim 27,

wherein the inclined radiation surface of said loaded dielectric is one of a surface inclined from an electric field plane of a radiated electromagnetic wave and a surface inclined from a magnetic field plane of the radiated electromagnetic wave.

Claim 44 **(New)** The dielectric loaded antenna apparatus as claimed in claim 28,

wherein the inclined radiation surface of said loaded dielectric is one of a surface inclined from an electric field plane of a radiated electromagnetic wave and a surface inclined from a magnetic field plane of the radiated electromagnetic wave.

Claim 45 **(New)** The dielectric loaded antenna apparatus as claimed in claim 29,

wherein the inclined radiation surface of said loaded dielectric is one of a surface inclined from an electric field plane of a radiated electromagnetic wave and a surface inclined from a magnetic field plane of the radiated electromagnetic wave.

Claim 46 **(New)** The dielectric loaded antenna apparatus as claimed in claim 27, further comprising a circularly polarized wave radiating device for radiating an electromagnetic wave radiated from the dielectric loaded antenna apparatus as a circularly polarized wave.

Claim 47 **(New)** The dielectric loaded antenna apparatus as claimed in claim 28, further comprising a circularly polarized wave radiating device for radiating an electromagnetic wave radiated from the dielectric loaded antenna apparatus as a circularly polarized wave.

Claim 48 **(New)** The dielectric loaded antenna apparatus as claimed in claim 29, further comprising a circularly polarized wave radiating device for radiating an electromagnetic wave radiated from the dielectric loaded antenna apparatus as a circularly polarized wave.

Claim 49 **(New)** The dielectric loaded antenna apparatus as claimed in claim 46, wherein the opening of said radiation waveguide has a hexagonal shape to form said circularly polarized wave radiating device.

Claim 50 **(New)** The dielectric loaded antenna apparatus as claimed in claim 47, wherein the opening of said radiation waveguide has a hexagonal shape to form said circularly polarized wave radiating device.

Claim 51 **(New)** The dielectric loaded antenna apparatus as claimed in claim 48, wherein the opening of said radiation waveguide has a hexagonal shape to form said circularly polarized wave radiating device.

Claim 52 **(New)** An array antenna apparatus comprising a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide.

Claim 53 (New) An array antenna apparatus comprising a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide toward one of a polarization direction of the electromagnetic wave and a direction perpendicular to the polarization direction of the electromagnetic wave.

Claim 54 (New) An array antenna apparatus comprising a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said feeding waveguide is arranged so that a central axis of said feeding waveguide in an axial direction of said feeding waveguide is shifted from a center of said column-shaped radiation waveguide.

Claim 55 (New) The array antenna apparatus as claimed in claim 52,

wherein the respective inclined radiation surfaces of said column-shaped loaded dielectrics of said dielectric loaded antenna apparatuses are inclined at a predetermined inclination angle in a predetermined direction so as to attain a predetermined directivity pattern of the array antenna apparatus.

Claim 56 (New) The array antenna apparatus as claimed in claim 53,

wherein the respective inclined radiation surfaces of said column-shaped loaded dielectrics of said dielectric loaded antenna apparatuses are inclined at a predetermined inclination angle in a predetermined direction so as to attain a predetermined directivity pattern of the array antenna apparatus.

Claim 57 (New) The array antenna apparatus as claimed in claim 54,

wherein the respective inclined radiation surfaces of said column-shaped loaded dielectrics of said dielectric loaded antenna apparatuses are inclined at a predetermined inclination angle in a predetermined direction so as to attain a predetermined directivity pattern of the array antenna apparatus.

Claim 58 (New) The array antenna apparatus as claimed in claim 52, further comprising a switching device for selectively switching between said column-shaped loaded dielectrics to connect a selected one of said column-shaped loaded dielectrics to a feeding line of the array antenna apparatus.

Claim 59 (New) The array antenna apparatus as claimed in claim 53, further comprising a switching device for selectively switching between said column-shaped loaded dielectrics to connect a selected one of said column-shaped loaded dielectrics to a feeding line of the array antenna apparatus.

Claim 60 (New) The array antenna apparatus as claimed in claim 54, further comprising a switching device for selectively switching between said column-shaped loaded dielectrics to connect a selected one of said column-shaped loaded dielectrics to a feeding line of the array antenna apparatus.

Claim 61 (New) The array antenna apparatus as claimed in claim 52,
wherein an arrangement of said respective column-shaped loaded dielectrics is changable according to an installation position of the array antenna apparatus.

Claim 62 (New) The array antenna apparatus as claimed in claim 53,
wherein an arrangement of said respective column-shaped loaded dielectrics is changable according to an installation position of the array antenna apparatus.

Claim 63 (New) The array antenna apparatus as claimed in claim 54,
wherein an arrangement of said respective column-shaped loaded dielectrics is changable according to an installation position of the array antenna apparatus.

Claim 64 (New) An array antenna apparatus comprising a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses including a feeding line and a column-shaped loaded dielectric loaded on an end portion of said feeding line, said column-shaped loaded dielectric having an inclined

radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric,

wherein at least one of said plurality of dielectric loaded antenna apparatuses is removable based on an installation position of the array antenna apparatus.

Claim 65 (New) An array antenna apparatus comprising a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses including a feeding line and a column-shaped loaded dielectric loaded on an end portion of said feeding line, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric,

wherein said dielectric loaded antenna apparatuses are arranged so that linear polarized waves of electromagnetic waves radiated from each pair of said dielectric loaded antenna apparatuses arranged to be adjacent to each other among said dielectric loaded antenna apparatuses are perpendicular to each other.

Claim 66 (New) A radio communication apparatus comprising:

a substrate;

a dielectric loaded antenna apparatus arranged on said substrate; and

a radio transceiver circuit provided on a surface of said substrate or in said substrate, said radio transceiver circuit being connected with said dielectric loaded antenna apparatus, wherein said dielectric loaded antenna apparatus comprises:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric,

wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide.

Claim 67 (New) A radio communication apparatus comprising:

a substrate;

a dielectric loaded antenna apparatus arranged on said substrate; and

a radio transceiver circuit provided on a surface of said substrate or in said substrate, said radio transceiver circuit being connected with said dielectric loaded antenna apparatus, wherein said dielectric loaded antenna apparatus comprises:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide toward one of a polarization direction of the electromagnetic wave and a direction perpendicular to the polarization direction of the electromagnetic wave.

Claim 68 (New) A radio communication apparatus comprising:

a substrate;

a dielectric loaded antenna apparatus arranged on said substrate; and

a radio transceiver circuit provided on a surface of said substrate or in said substrate, said radio transceiver circuit being connected with said dielectric loaded antenna apparatus,

wherein said dielectric loaded antenna apparatus comprises:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said feeding waveguide is arranged so that a central axis of said feeding waveguide in an axial direction of said feeding waveguide is shifted from a center of said column-shaped radiation waveguide.

Claim 69 (New) The radio communication apparatus as claimed in claim 66, further comprising a modulator and demodulator circuit provided on the surface of said substrate or in said substrate, said modulator and demodulator circuit being connected with said radio transceiver circuit.

Claim 70 (New) The radio communication apparatus as claimed in claim 67, further comprising a modulator and demodulator circuit provided on the surface of said substrate or in said substrate, said modulator and demodulator circuit being connected with said radio transceiver circuit.

Claim 71 (New) The radio communication apparatus as claimed in claim 68, further comprising a modulator and demodulator circuit provided on the surface of said substrate or in said substrate, said modulator and demodulator circuit being connected with said radio transceiver circuit.

Claim 72 (New) A radio communication apparatus comprising:

a substrate;

an array antenna apparatus arranged on said substrate; and

a radio transceiver circuit provided on a surface of said substrate or in said substrate, said radio transceiver circuit being connected with said array antenna apparatus,

wherein said array antenna apparatus comprises a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide.

Claim 73 (New) A radio communication apparatus comprising:

a substrate;

an array antenna apparatus arranged on said substrate; and

a radio transceiver circuit provided on a surface of said substrate or in said substrate, said radio transceiver circuit being connected with said array antenna apparatus,

wherein said array antenna apparatus comprises a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said column-shaped loaded dielectric is arranged so that a central axis of said column-shaped loaded dielectric is shifted from a central axis of said radiation waveguide toward one of a polarization direction of the electromagnetic wave and a direction perpendicular to the polarization direction of the electromagnetic wave.

Claim 74 (New) A radio communication apparatus comprising:

a substrate;

an array antenna apparatus arranged on said substrate; and

a radio transceiver circuit provided on a surface of said substrate or in said substrate, said radio transceiver circuit being connected with said array antenna apparatus,

wherein said array antenna apparatus comprises a plurality of dielectric loaded antenna apparatuses apart from each other by a predetermined distance, each of said dielectric loaded antenna apparatuses comprising:

a waveguide; and

a column-shaped loaded dielectric loaded on an end portion of said waveguide, said column-shaped loaded dielectric having an inclined radiation surface which is inclined from a surface perpendicular to an axial direction of said column-shaped loaded dielectric, wherein said waveguide includes:

a radiation waveguide having an axis parallel to the axial direction of said column-shaped loaded dielectric and including an opening for feeding an electromagnetic wave to said column-shaped loaded dielectric; and

a feeding waveguide for feeding the electromagnetic wave to said radiation waveguide, and

wherein said feeding waveguide is arranged so that a central axis of said feeding waveguide in an axial direction of said feeding waveguide is shifted from a center of said column-shaped radiation waveguide.

Claim 75 (New) The radio communication apparatus as claimed in claim 72, further comprising a modulator and demodulator circuit provided on the surface of said substrate or in said substrate, said modulator and demodulator circuit being connected with said radio transceiver circuit.

Claim 76 (New) The radio communication apparatus as claimed in claim 73, further comprising a modulator and demodulator circuit provided on the surface of said substrate or in said substrate, said modulator and demodulator circuit being connected with said radio transceiver circuit.

Claim 77 (New) The radio communication apparatus as claimed in claim 74, further comprising a modulator and demodulator circuit provided on the surface of said substrate or in said substrate, said modulator and demodulator circuit being connected with said radio transceiver circuit.